

107. (New) The method of claim 105, wherein the oxygen source is selected from the group consisting of nitrous oxide (N₂O), oxygen (O₂), ozone (O₃), carbon monoxide (CO), carbon dioxide (CO₂) and combinations thereof.

108. (New) The method of claim 107, wherein the oxygen source is provided to the deposition chamber at a flow rate in a range of about 10 sccm to about 200 sccm.

109. (New) The method of claim 108, wherein the ratio of the oxygen source to the organosilane compound is about 1:1 to about 1:5.

REMARKS

This is intended as a full and complete response to the Office Action dated April 7, 2003, having a shortened statutory period for response set to expire on July 7, 2003. Please reconsider the claims pending in the application for reasons discussed below.

Claims 1, 4-24 and 74-109 are pending in the application following entry of this response. The Applicant cancels claims 2, 3 and 25-73 without prejudice and may elect to pursue these claims in a continuation patent application. Claims 1 and 4-24 stand rejected and are amended. New claims 74-109 are added.

According to the Examiner, a restriction to one or more of the following inventions is required, such as:

Group I, Claims 1-24,

Group II, Claims 25-73.

During a telephone conversation on 06/21/2002, a provisional election was made with traverse to prosecute the invention of Group I, claims 1-24. The Applicant elects Group I, claims 1-24. The Applicant cancels Group II, claims 25-73.

The Examiner objects to claims 4, 13, 14 and 23 due to various informalities. The claims have been amended to correct the informalities.

Claims 1 and 2 stand rejected under 35 U.S.C. § 102(e) as being anticipated by *Chiang, et al.*, U.S. Patent Publication No. 2002/0068458 A1, (*Chiang*). Claim 1 has

been amended to include the subject matter of claims 2 and 3. The Examiner asserts that *Chiang* discloses a method of thin film deposition for integrated circuit fabrication, comprising providing a substrate, forming an organosilicate layer on the substrate and treating the organosilicate layer with a plasma. The Applicant respectfully traverses the rejection.

Chiang teaches the use of atomic hydrogen or halogen radicals to react with the surface contaminants, such as oxides, to form byproducts that are easily pumped away. Also, *Chiang* teaches the use of hydrogen radicals to remove weakly bonded surface species from an organosilicate surface. *Chiang* does not teach, show or suggest a method of thin film deposition for integrated circuit fabrication, comprising providing a substrate, treating the substrate with a plasma prior to forming an organosilicate layer, wherein the plasma is generated in a reaction chamber by applying an electric field to a gas mixture comprising molecular oxygen (O_2) gas and molecular hydrogen (H_2) gas, forming the organosilicate layer on the substrate, and treating the organosilicate layer with the plasma. Claim 1, as amended, is believed to be in condition for allowance. The Applicant respectfully request withdrawal of the rejection.

Claims 3-10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chiang* in view of *Jiang, et al.*, U.S. Patent Publication No. 2002/0081855 A1, (*Jiang*). The Examiner asserts that *Chiang* discloses all limitations claimed except for the plasma steps (b) and (d) are generated in a reaction chamber by applying an electric field comprising oxygen and hydrogen, while *Jiang* shows H_2O_2 plasma chemistry is an equivalent plasma chemistry known in the art. The Applicant respectfully traverses the rejection.

The comments to *Chiang* are relied upon from above. *Jiang* teaches an *in-situ* O_2 plasma treatment as a preferred embodiment and provides alternative plasmas such as H_2 , H_2O , H_2O_2 , O_3 , CO , CO_2 and SO_2 . *Jiang* never teaches combining these respective plasmas nor does *Jiang* teach that a plasma formed from H_2O_2 is equivalent to a plasma formed from molecular H_2 and molecular O_2 . In fact, *Jiang* teaches the plasma derived from hydrogen peroxide (H_2O_2), a single compound, whereas the present invention discloses a plasma derived from a mixture of compounds, namely molecular hydrogen gas (H_2) and molecular oxygen gas (O_2). Therefore, neither *Chiang*

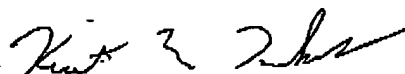
nor *Jiang*, alone or in combination, teach, show or suggest the invention. The claims are believed to be in condition for allowance. The Applicant respectfully request withdrawal of the rejections.

Claims 11-24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chiang* in view of *Vincent, et al.*, U.S. Publication No. 2002/0142579 A1, (*Vincent*). The Examiner asserts that *Chiang* discloses all limitations claimed expect for a method of forming the organosilicate layer and the silicon and carbon sources, as disclosed by *Vincent*. The Applicant respectfully traverses the rejection.

The comments to *Chiang* are relied upon from above. *Vincent* teaches using CVD and PECVD to make various films using silicon sources. However, *Chiang* has been distinguished above and *Vincent* does not supply the deficiencies of *Chiang*. Therefore, neither *Chiang* nor *Vincent*, alone or in combination, teach, show or suggest the invention. The claims are believed to be in condition for allowance. The Applicant respectfully request withdrawal of the rejections.

In conclusion, the references cited by the Examiner, neither alone nor in combination, teach, show or suggest the method of the present invention. Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

1. (Amended) A method of thin film deposition for integrated circuit fabrication, comprising:

[(a)] providing a substrate;

treating the substrate with a plasma prior to forming a organosilicate layer, wherein the plasma is generated in a reaction chamber by applying an electric field to a gas mixture comprising molecular oxygen (O₂) and molecular hydrogen (H₂);

[(b)] forming [an] the organosilicate layer on the substrate; and

[(c)] treating the organosilicate layer with [a] the plasma.

4. (Amended) The method of claim [3] 1, wherein the gas mixture further comprises at least one [or more inert] gas[es] [are] selected from the group consisting of helium (He), argon (Ar), nitrogen (N₂), and combinations thereof.

5. (Amended) The method of claim [3] 1, wherein the electric field is provided by a radio frequency (RF) power.

6. (Amended) The method of claim 5, wherein the RF power is within a range of about 1 watt/cm² to about 100 watts/cm².

7. (Amended) The method of claim [3] 1, wherein the reaction chamber is maintained at a pressure within a range of about 1 I[t]orr to about 10 I[t]orr.

8. (Amended) The method of claim [3] 1, wherein the plasma treatment is performed at a temperature within a range of about 50 °C to about 400 °C.

9. (Amended) The method of claim [3] 1, wherein the oxygen (O₂)/hydrogen (H₂) gases are provided to the reaction chamber at flow rates within a range of about 500 sccm to about 5,000 sccm.

10. (Amended) The method of claim 4, wherein the at least one [or more inert] gas[es] [are] is provided to the reaction chamber at flow rates within a range of about 500 sccm to about 5,000 sccm.

11. (Amended) The method of claim 1, wherein the organosilicate layer is formed by:

[(e)] positioning the substrate in a deposition chamber;

[(f)] providing a second gas mixture to the deposition chamber, wherein the second gas mixture comprises a silicon source, a carbon source, and an oxygen source; and

[(g)] applying an electric field to the second gas mixture in the deposition chamber to form the carbon-containing silicate layer on the substrate.

12. (Amended) The method of claim 11, wherein the silicon source and the carbon source comprise an organosilane compound having the general formula $\text{Si}_a\text{C}_b\text{H}_c\text{O}_d$, where a has a range between 1 and 2, b has a range between 1 and 10, c has a range between 6 and 30, and d has a range between 0 and 6.

13. (Amended) The method of claim 12, wherein the organosilane compound is selected from the group consisting of methylsilane (SiCH_3), dimethylsilane (SiC_2H_6), trimethylsilane ($\text{SiC}_3\text{H}_{10}$), tetramethylsilane ($\text{SiC}_4\text{H}_{12}$), methoxysilane (SiCH_3O), dimethyldimethoxysilane ($\text{SiC}_4\text{H}_{12}\text{O}_2$), diethyldiethoxysilane [$(\text{SiC}_6\text{H}_{18}\text{O}_2)$] ($\text{SiC}_8\text{H}_{20}\text{O}_2$), dimethyldiethoxysilane ($\text{SiC}_6\text{H}_{16}\text{O}_2$), diethyldimethoxysilane ($\text{SiC}_8\text{H}_{16}\text{O}_2$), hexamethyldisiloxane ($\text{Si}_2\text{C}_6\text{H}_{18}\text{O}$), bis(methylsilano)methane ($\text{Si}_2\text{C}_3\text{H}_{12}$), 1,2-bis(methylsilano)ethane ($\text{Si}_2\text{C}_4\text{H}_{14}$), and combinations thereof.

14. (Amended) The method of claim 11, wherein the oxygen source is selected from the group consisting of nitrous oxide (N_2O), oxygen (O_2), ozone (O_3), carbon monoxide (CO), carbon dioxide (CO_2), and combinations thereof.

15. (Amended) The method of claim 11, wherein the electric field applied to the second gas mixture in the deposition chamber is provided by a radio frequency (RF) power.

16. (Amended) The method of claim 15, wherein the RF power is within a range of about 1 watt/cm² to about 500 watts/cm².

17. (Amended) The method of claim 11, wherein the deposition chamber is maintained at a pressure between about 1 μ orr to about 500 μ orr.

18. (Amended) The method of claim 12, wherein the organosilane compound is provided to the deposition chamber at a flow rate in a range of about 50 sccm to about 1,000 sccm.

19. (Amended) The method of claim 11, wherein the oxygen source is provided to the deposition chamber at a flow rate in a range of about 10 sccm to about 200 sccm.

20. (Amended) The method of claim 12, wherein the ratio of the oxygen source to the organosilane compound is about 1:1 to about 1:5.

21. (Amended) The method of claim 11, wherein the deposition chamber is maintained at a temperature between about 50 °C to about 500 °C.

22. (Amended) The method of claim 11, wherein the second gas mixture further comprises an inert gas.

23. (Amended) The method of claim 22, wherein the inert gas is selected from the group consisting of helium (He), argon (Ar), neon (Ne), xenon (Xe), and combinations thereof.

24. (Amended) The method of claim 22, wherein the inert gas is provided to the deposition chamber at a flow rate in a range of about 10 sccm to about 1,000 sccm.